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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: November 25, 1986

SUBJECT: Approval of Quality Assurance Project Plan for the Residential Well Water Test at City of St. Louis Park, Minnesota - GAC Plant

FROM: James H. Adams, Jr., Chief
Quality Assurance Office

TO: Norman Niedergang, Chief
CERCLA Enforcement Section

ATTENTION: Dan Bicknell, RPM

We are returning a copy of an approved QAPP for the Residential Well Water Test at the City of St. Louis Park Site, Minnesota - GAC Plant (QAO #229). The original of the signature page is included. Please have the Remedial Project Manager provide final sign off. We have retained a copy of the QAPP for our record.

Enclosure

cc: M. Gade, WMD
T. Rutter, ERRB
S. Hong, CES

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QUALITY ASSURANCE PROJECT PLAN
RESIDENTIAL WELL WATER TEST
for
CITY OF ST. LOUIS PARK, MINNESOTA
(REILLY TAR, MINNESOTA SITE)

PREPARED BY: City of St. Louis Park, MN
LABORATORY: ERT
696 Virginia Road
Concord, Massachusetts 01742

DATE:

APPROVALS: Daniel J. Bickett DATE 11/18/86
RPM, REGION V

James M. Adams Jr. DATE 11/25/86
QA OFFICER, REGION V

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Quality Assurance Project Plan For Interim Sampling and Analysis June-August, 1986

Prepared for:

The City Of
St. Louis Park
Minnesota

ERT
A RESOURCE ENGINEERING COMPANY

Document No. P-D209-129-1

Quality Assurance Project Plan for Sampling and Analysis – GAC Plant Testing June-August, 1986

Prepared for:

The City of St. Louis Park
Minnesota

October 1986

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Background

Groundwater in the City of St. Louis Park, Minnesota has been contaminated by activities at a coal-tar distillation and wood preserving plant operated from 1917 to 1972. A comprehensive report, prepared by ERT for Reilly Tar and Chemical Co., identified numerous polynuclear aromatic hydrocarbons (PAH) present in various aquifers beneath St. Louis Park and adjacent communities. Based upon extensive study of the migration, toxicity, and fate of PAH in the groundwater, ERT proposed a program of groundwater monitoring, treatment, and associated remedial measures, together with recommended water quality criteria for PAH, aimed at protecting the public health and reopening affected drinking water supply wells.

Through negotiations with the Environmental Protection Agency (EPA), the Minnesota Pollution Control Authority (MPCA), the Minnesota Department of Health (MDH), and St. Louis Park (SLP), acceptable water quality criteria were established. These criteria, incorporated into the final Federal Court Consent Decree, set the following concentration levels:

	Advisory Level	Drinking Water Criteria
• Sum of benzo(a) pyrene and dibenz(a,h) anthracene	3.0 ng/ℓ*	5.6 ng/ℓ
• Carcinogenic PAH	15 ng/ℓ	28 ng/ℓ
• Other PAH	175 ng/ℓ	280 ng/ℓ

*or the lowest concentration that can be quantified, whichever is greater.

In conjunction with the implementation of remedial measures to limit the spread of contaminants, a granular activated carbon (GAC) treatment system has been installed to treat water from St. Louis Park (SLP) wells 10 and 15. In order to demonstrate the effectiveness of the GAC treatment system, a five-week sampling and analysis program will be implemented during the period of June through August, 1986. This plan provides procedures for this sampling and analysis program.

1.2 Quality Objectives

The principal objectives of this plan pertain to the collection of data that are sufficient to demonstrate, confidently and objectively, the effectiveness of the GAC treatment system. Therefore, the quality of the data gathered in this project can be defined in terms of the following elements:

- Completeness - a sufficient number of successful (valid) measurements to characterize the concentrations of PAH in the influent and effluent of the treatment system over an operational period.
- Representativeness - the extent to which reported analytical results truely depict the PAH concentrations in the influent and effluent of the treatment system. Representativeness is optimized through proper selection of sampling sites, times and procedures, through proper sample preservation, and through prompt extraction and analysis.
- Accuracy and Precision - Accurate and precise data will be achieved through the use of sampling and analytical procedures that minimize biases, through the use of standard procedures, through the meticulous calibration of analytical equipment and by implementing corrective action whenever measured accuracy and precision exceed pre-established limits. Accuracy and precision will be measured by the analysis of method spikes and duplicate samples.
- Comparability - the extent to which comparisons among separate measurements will yield valid conclusions. Comparability among measurements in the SLP project will be achieved through the use of rigorous standard sampling and analytical procedures.
- Traceability - the extent to which results can be substantiated by hard-copy documentation. Traceability documentation exists in two forms: that which links final numerical results to authoritative measurement standards, and that which explicitly describes the history of each sample from collection to analysis.

This plan describes the procedures that will be implemented to ensure quality as defined above.

1.3 Project Organization and Responsibilities

The project organization is illustrated in Figure 1-1. The ERT Quality Assurance Department is completely independent of line function. Its

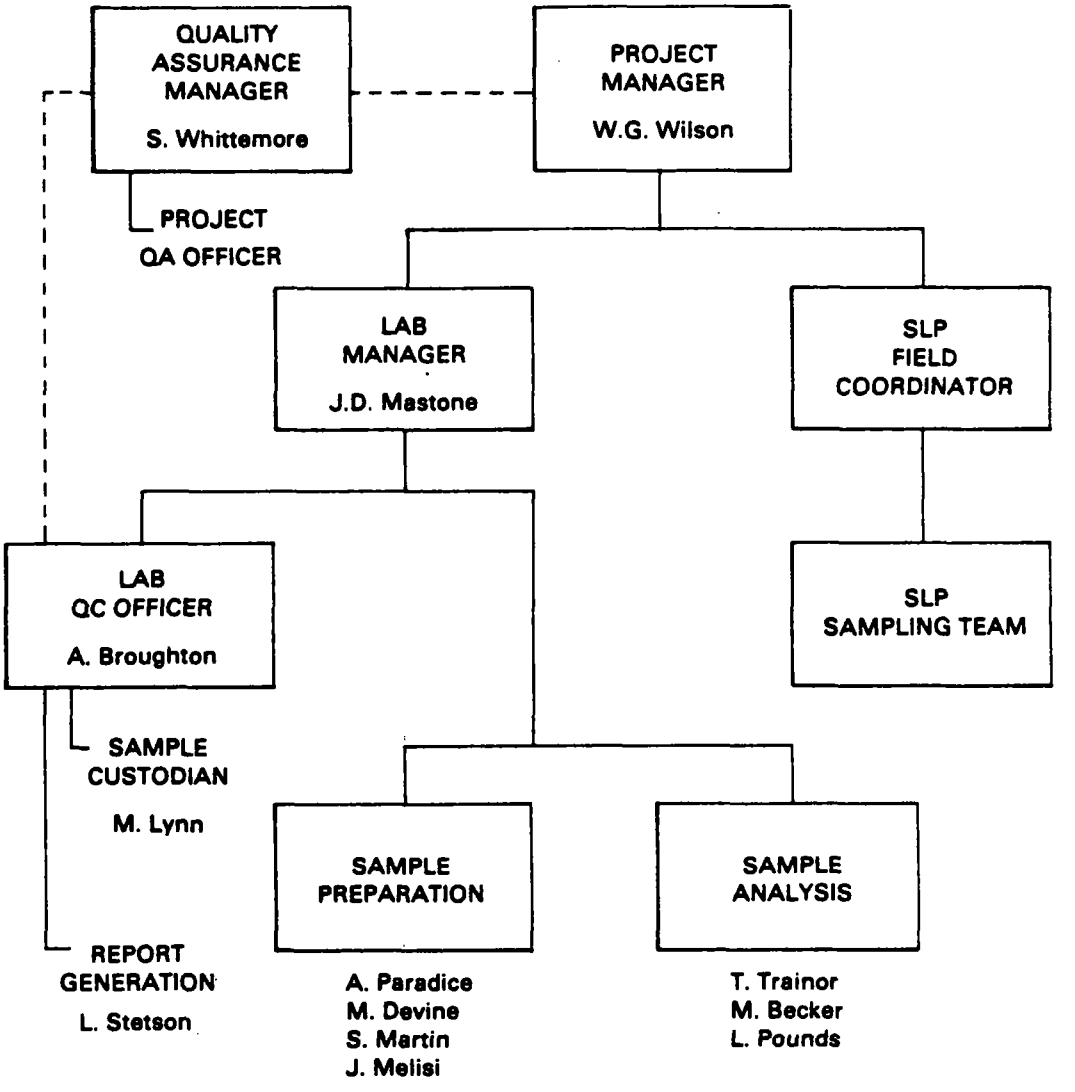

Figure 1-1 Project Organizational Chart

manager reports directly and exclusively to the ERT Executive Vice President. Members of the QA Department are called Quality Assurance Officers. The Laboratory Quality Control Coordinator is appointed by the Chemistry Division Manager and reports directly to the Division Manager, with ancillary responsibilities to the Laboratory Manager and the Corporate Quality Assurance Manager.

All other functions in the organizational structure report directly through line management. Responsibilities of the key positions in the organization are described below:

- Principal-in-Charge: The Principal-in-Charge is a senior manager with sufficient corporate influence to assure that the necessary staff and resources are committed to a timely completion of the program.
- Project Manager: The Project Manager's responsibilities include correspondence, review of all project data, scheduling of activities, and authorization of revisions to the Site Operations Plan and the QA Plan.
- Laboratory Manager: The Laboratory Manager is responsible for overall management of laboratory operations to meet project commitments, including scheduling of personnel and physical resources.
- Laboratory QC Coordinator: The Laboratory QC Coordinator is responsible for maintaining the laboratory Quality Control program. The Laboratory QC Coordinator maintains laboratory standards and traceability documentation and performs analytical data package validation. The Laboratory QC Coordinator reports directly to the Laboratory Manager, but also has indirect reporting responsibility to the Quality Assurance Manager.
- Laboratory Section Supervisor: The Laboratory Section Supervisor is responsible for supervising all aspects of sample preparation and analysis performed by analysts and technicians.
- Sample Custodian: The Sample Custodian is responsible for issuance of sampling kits to the Field Coordinator and for inspection and log-in of incoming samples and control of sample storage.
- Report Coordinator: The Report Coordinator is responsible for the review of raw data and corresponding data tables, compiling summary tables of sample results and corresponding QA/QC, and preparation of rough draft reports for review and comments by supervisors and managers.

- Field Coordinator: The Field Coordinator is responsible for the coordination and effective use of all personnel on site and will maintain a general log of activities. The Field Coordinator will also be responsible for issuance and tracking of measurement and test equipment, the proper labeling, handling, storage, shipping, and chain of custody procedures used at the time of sampling, and control and archiving of all field documentation, (log books, notebooks, data sheets, etc.) generated during the field investigation.
- Sampling Geologists/Engineers: The Sampling Geologists/Engineers responsibilities include collecting soil, water, and waste samples; conducting field measurements; and maintaining proper decontamination procedures; all according to documented procedures stated in the Quality Assurance Plan and the corresponding SOPs.
- Analyst: The Analyst is responsible for the analysis of water samples for trace level (part per trillion) PAHs utilizing selected ion monitoring gas chromatography mass spectrometry (GC/MS) (according to documented procedures stated in Section 4.0). This requires experience in and knowledge of organic compound analysis utilizing gas chromatography and mass spectrometry, the operation of sophisticated GC/MS instrumentation and the interpretation of mass spectra.
- Technician: The Technician is responsible for sample extraction (according to documented procedures stated in Section 4.4). This requires practical experience and knowledge in the techniques of liquid--liquid solvent extraction, Kuderna Danish evaporation, and the quantitative preparation of sample extracts for analysis.

2. SAMPLING PROTOCOL

2.1 Sampling Schedule and Locations

The sampling schedule is shown in Table 2-1. This schedule will result in the collection of five treated water samples, five duplicate treated water samples, two feed water samples, three wellhead samples, and five treated water samples for method spike analysis.

The sampling locations referred to in Table 2-1 are depicted in Figure 2-1, with the exception of the SLP 7 and SLP 9 well heads.

2.2 Sampling Procedures

All sampling will be performed under the direction of the St. Louis Park Water Department personnel. All sampling materials will be provided by ERT, including bottles, labels, tapes, shipping containers and chain-of-custody forms.

Samples should be collected at a convenient time during the normal working day on the days shown in Table 2-1. Samples scheduled for the same day will be collected in close succession, moving from downstream to upstream sampling locations. Field blanks will be collected just before process sampling begins. Two sets of duplicate samples will be collected at treated water sampling points on each day. One set of duplicate treated water samples will be designated as a treated water duplicate set and the second duplicate water sample shall be designated for method spike analysis.

Chain-of-custody forms should be completed (Sec. 2.3) and all samples shipped to ERT's laboratory by overnight delivery on the same day they are collected.

Sampling points should be flushed for at least five minutes before collecting a sample. Each PAH sample will be collected in four one-liter amber glass bottles, which should be filled and capped in succession. PAH sample bottles should not be rinsed before being filled. The lids of all sample bottles should be taped after they are capped.

All sample bottles should be labeled just before they are used. The date, time, sampler's initials, type of analysis ("PAH") and sample number should all be recorded on the label. The sample number is a three character figure, X-NN, assigned as follows:

TABLE 2-1

WATER SAMPLING

GAC PLANT OPERATION

JULY - AUGUST, 1986

Date	Sample Description	Sample Number
July 15	- GAC treated water - Vessels I & II	T-01
	- GAC feed water (SLP 10)	F-01
	- SLP 9 wellhead	W-01
	- Blank	B-01
	- Duplicate of GAC treated water	TD-01
	- Method spike for GAC treated water	MS-01
July 22	- GAC treated water - Vessels I & II	T-02
	- SLP 7 wellhead	W-02
	- Blank	B-02
	- Duplicate of GAC treated water	TD-02
	- Method spike for GAC treated water	MS-02
July 29	- GAC treated water - Vessels I & II	T-03
	- GAC feed water (SLP 10)	F-03
	- SLP 7 or 9 wellhead	W-03
	- Blank	B-03
	- Duplicate of GAC treated water	TD-03
	- Method spike for GAC treated water	MS-03
August 5	- GAC treated water - Vessels I & II	T-04
	- SLP 7 or 9 wellhead	W-04
	- Blank	B-04
	- Duplicate of GAC treated water	TD-04
	- Methos spike for GAC treated water	MS-04
August 26	- GAC treated water - Vessels I & II	T-05
	- Blank	B-05
	- Duplicate of GAC treated water	TD-05
	- Method spike for GAC treated water	MS-05

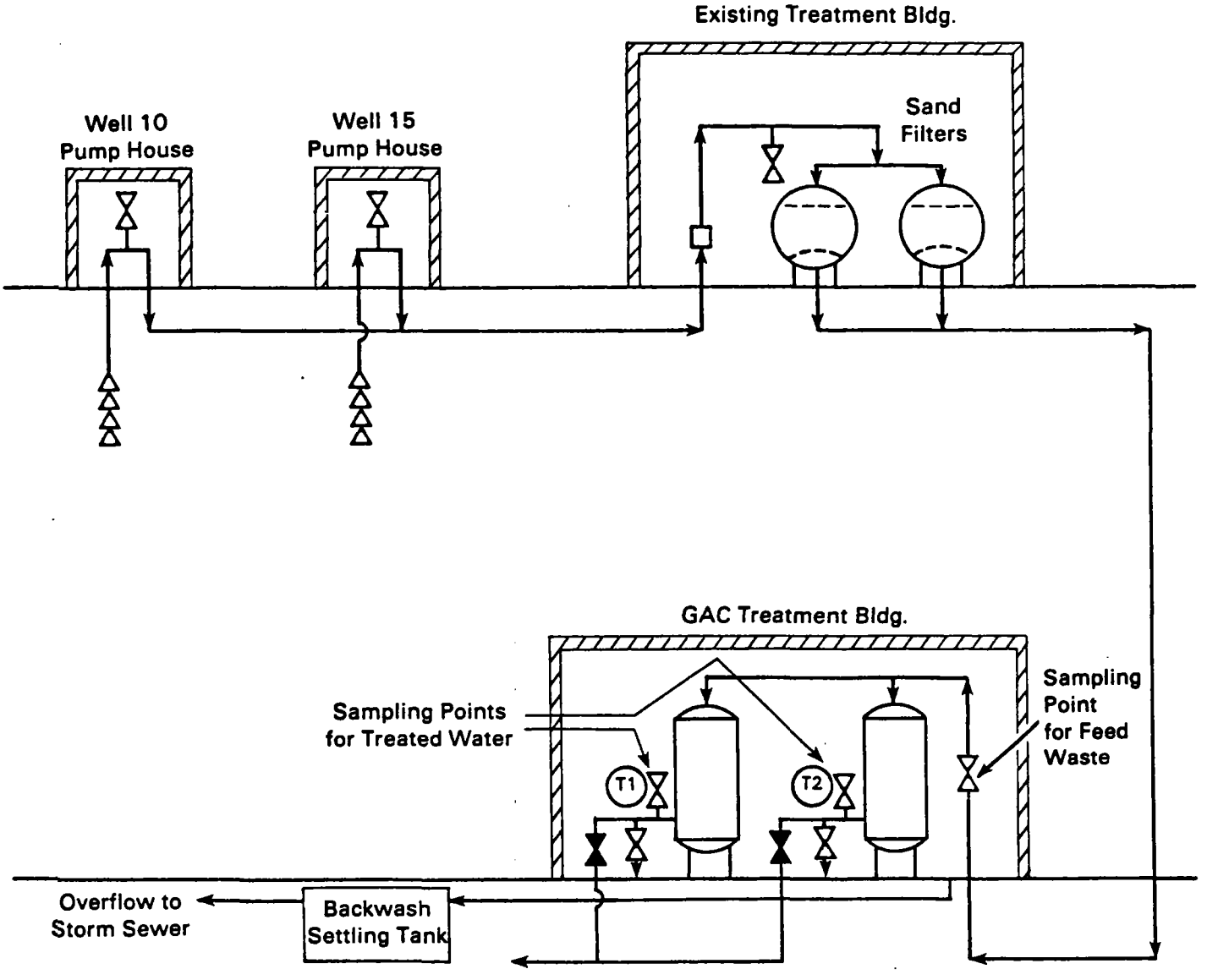

Figure 2-1 Sampling Locations

X = sampling position (See Figure 2-1), i.e.:
- W = wellhead water
- F = GAC feed water
- T = GAC treated water
- B = field blank
- FD = feedwater duplicate
- TD = treated water duplicate

NN = test day number, e.g.,
- 01 = first day of sampling
- 05 = last day of sampling

The resulting sample numbers are indicated in Table 2-1. (Note that the test day numbers shown in Table 2-1 may have to be adjusted somewhat based on the GAC system operation schedule).

The GAC treated water samples will have to be collected from two sample taps -- one for each column (see Figure 2-1). This should be done by filling two one-liter bottles from the first column sample tap and then two more bottles from the second (four from each for duplicate samples). No notations distinguishing the two taps should be made on the labels. All four PAH bottles will be extracted and the extracts composited for analysis.

Field blank samples will be prepared by transferring contaminant-free deionized water provided by ERT into sample bottles in a fashion as closely similar to actual sample collection as possible. Field blank sample bottles should be filled, capped and taped in succession with individual bottles open to the atmosphere for an equal time as for actual process samples. Field blanks should be prepared in the area in which GAC treated water samples are collected.

Duplicate samples are obtained by filling eight 1-liter bottles at the sampling point by the procedure described above, splitting these into two groups of four bottles, and assigning a different sample number to each of th resulting four-bottle samples. For example, when the duplicate sample is collected from SLP-10 on June 17 (see Table 2-1) four bottles will be labeled "F-01" and four bottles will be labeled "FD-01".

All samples should be packed, cooled to a temperature less than 4°C, and shipped on the day they are collected. All sample handling, packaging and shipping should follow ERT's Standard Operating Procedure No. 7510 (Appendix A). One cooler will be used for each day's sampling.

The sampling team must recognize that great care is required to collect samples for part-per-trillion-level PAH analysis that are free from outside contamination. PAH compounds are present in cigarette smoke, engine exhaust and many petroleum derived oils, among other sources. There should be no smoking anywhere in the GAC treatment building on a day on which PAH samples are to be collected until the samples have been collected, sealed and packaged for shipment. Similarly, no vehicles should enter the GAC treatment building and the large access door should stay closed on sampling days. Disposable gloves should be worn when collecting, handling and packaging samples. Sample bottles should remain in closed shipping coolers until they are needed, and should be packaged and sealed for shipment as soon as possible after sampling.

2.3 Chain-of-Custody Procedures

Sample chain-of-custody is initiated upon sample collection in the field by the sampler. The chain of custody for each sample is documented on the chain-of-custody. Form (see Figure 2-2) which must include the following pertinent information:

- Sampling site identification,
- Sampling date and time.
- Identification of sample collector,
- Sample identification number (see Table 2-1),
- Sample description (type, quantity and physical observations), and
- Analyses to be performed.

This information should also be included on the sample label which is adhered to each sample bottle.

The field sampler is personally responsible for the care and custody of the samples collected until they are transferred or dispatched to the laboratory. A sample is under custody if:

- It is in your possession, or
- It is in your view, after being in your possession, or
- It was in your possession and you locked it up to prevent tampering, or
- It is in a designated secure area.

CHAIN OF CUSTODY RECORD

Client/Project Name	Project Location	ANALYSES
Project No.	Field Logbook No.	
Sampler: (*Signature*)	Chain of Custody Tape No.	

Sample No./ Identification	Date	Time	Lab Sample Number	Type of Sample							REMARKS

Relinquished by: (*Signature*)	Date	Time	Received by: (*Signature*)	Date	Time
Relinquished by: (*Signature*)	Date	Time	Received by: (*Signature*)	Date	Time
Relinquished by: (*Signature*)	Date	Time	Received for Laboratory: (*Signature*)	Date	Time
Sample Disposal Method	Disposed of by (*Signature*)			Date	Time

SAMPLE COLLECTOR	ANALYTICAL LABORATORY	
Environmental Research and Technology, Inc. 696 Virginia Road Concord, MA 01742 617-369-8910		ERT No

'974 • 84

Figure 2-2 Chain of Custody Record

Samples are accompanied by a Chain-of-Custody Record from the time they are collected. Samples will be packaged properly for shipment and dispatched to the laboratory for analysis, with a separate custody record accompanying each shipment. The original record will be sealed in the cooler; a copy will be retained by the Field Coordinator. Shipping containers will be sealed with chain-of-custody tape for shipment to the laboratory. Chain-of-custody tape numbers are entered on the corresponding chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents sample custody transfer from the sampler, often through another person, to the Sample Custodian at the laboratory. The method of shipment, courier name(s) and other pertinent information are entered in the "Remarks" box. The shipper's waybill or air bill number is retained by the last custodian prior to shipment. The chain-of-custody procedure resumes in the laboratory (see 3.1) and is maintained until the samples or extracts are disposed.

3. LABORATORY QUALITY CONTROL

The ERT Analytical Laboratory operates under a formal quality control program governed by ERT's Analytical Laboratory Quality Control Handbook. This section covers quality related activities applicable to the St. Louis Park Groundwater Study from the initiation of sample chain-of-custody to the issuance of validated analytical data. More specific detail of ERT's operation can be found in the handbook.

3.1 Chain-of-Custody/and Recordkeeping

When samples are received into the laboratory the sample custodian will verify their integrity as they are unpacked and will explicitly state in the log-in records whether the chain-of-custody seal is intact. The client shall be notified of any discrepancies found and any sample which does not meet the integrity criteria outlined in Chapter 7 of the ERT Analytical Laboratory Quality Control Handbook. If the integrity requirements are met, or when any discrepancies are resolved, ERT assigns the sample a laboratory control number, stores the sample in a refrigerator and enters the pertinent information into the sample log. Once the samples are in the laboratory, a sample usage log is maintained on the LIMS computer to track the transport and use of each sample within the laboratory.

The laboratory will retain a copy of each chain-of-custody record, with the shipper's waybill or air bill attached. After sample log-in, a second copy of the chain-of-custody record will be sent to the Field Coordinator, indicating sample receipt and associated ERT laboratory number. After disposition, the final copy will be sent documenting the disposition method and date.

In addition to sample chain-of-custody, the laboratory will maintain the necessary documentation to reconstruct the entire process of sample preparation through analysis and report generation. This documentation is found in logbooks, data packages and stored on tape.

The logbooks and information they contain are listed below. More thorough descriptions and examples of sample log sheets can be found in ERT's Analytical Quality Control Handbook.

- Chemical Inventory Log - ERT Chemical Inventory control number, compound/reagent name, manufacturer, lot number, grade, date received, expiration date and disposition date.
- Reference Standard Inventory Log - ERT Reference Standard Inventory control number, compound name, manufacturer, lot number, concentration, solvent, date received, expiration and disposition date.

- Super Stock Preparation Log - ERT Super Stock Standard number; neat compound and solvent or carrier name and their pertinent data such as lot number, manufacturer, percent activity, expiration date (if any), weights and volumes taken and balance used; final stock standard concentration, expiration date of standard, storage requirements and location, preparation date and time, preparer's initials, approval signature and date and comments regarding EPA reference standard verification.
- Mixed and/or Dilution Standards Log - ERT Mixed Standard number; pertinent information of Super Stock Standards used such as standard numbers, concentration, preparation date, volume taken, volume diluted to and solvent used (including lot number, manufacturer); mixed and/or dilution standards preparer's initials, date, final concentration of each component, storage, location, approval signature (of supervisor) and date disposed.
- Instrument Maintenance Log - initialed and dated entries pertaining to instrument set-up, routine preventative maintenance, and instrumental malfunction and resolutions.
- Instrument Sample Sequence Log - initialed and dated listing of standards and samples analyzed.
- Instrument Tuning Log - initialed and dated mass intensity listings of daily DFTPP tunes.

The data package contains only data pertinent to the individual project. This package is filed alphabetically by project and date and includes the following records:

- Data Approval Form - a form which lists the contents of the Data Package and routes the data review process.
- Out-of-Control Event Form - a form which describes any out-of-control events which affect the quality of data to be reported and explains the causes and corrective actions taken.
- Sample Receipt Checklist - a checklist describing sample integrity upon receipt into the laboratory.
- Initial Page - a sheet which lists the signatures and initials of all personnel involved in the preparation and review of the Data Package.
- Daily Log Sheet - a log containing daily entries or comments pertaining to any part of sample preparation and/or analysis, which are not described on the other forms such as instrument fluctuations and tuning or where the sample analysis sequence can be found, etc.
- Initial and continuous calibration data.

- Serial Dilution Sheet - a sheet which is used to describe how dilutions were made from mixed standards to be used as calibration standards or in-house spiking solutions. The following is required: Information about the super stock standards such as parameter, concentration, date prepared, ERT stock standard number, etc. and information about the serial standard preparation such as volume of standard taken, volume diluted to, solvent used, final concentrations, storage location, who prepared it and the date prepared.
- Analytical Results of QA/QC Fortified Samples (Method Spikes) - on this sheet one records pertinent preparation information for spiking samples (GAC treated water) such as volume or weight of sample spiked, concentration of standard used for spiking, and volume of spike used. From this information, one can then calculate the expected concentration of parameter spiked into the method spike sample.

In addition to these forms, a Data Package must contain other pertinent information such as daily instrument calibration, check standard results, chromatographic charts, computer printouts, references to other logbook entries and correspondences. Copies of all GC/MS raw data files are also transferred to magnetic tape. All data files are maintained in filing cabinets in a secured area for an indefinite amount of time.

3.2 Quality Control of Analysis

The quality control procedures specific to the analytical method include the determination of method detection limit, the interpretation of the results obtained from method blanks, solvent blanks, surrogates, duplicate samples and method spikes. Laboratory error will be determined based only upon the criteria discussed below for surrogate recovery and method spike recovery.

Method Detection Limit

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero. This is determined from replicate analyses of a sample of a given matrix containing the analyte near the estimated detection limit.

ERT has determined the method detection limits for the part per trillion PAH analysis of water samples, utilizing GC/MS selected ion monitoring, as per the method described in Appendix B to Part 136 of the Friday, October 26, 1984 Federal Register, Vol. 49, No. 209 - Definition and Procedure for the Determination of the Method Detection Limit - Revision 1.11. Table 3-1 lists the compounds, the mean observed concentration of seven replicates spiked at 5 parts per trillion, the standard deviation, the method detection limit and the lower control limit (defined as 0.64 MDL).

TABLE 3-1

METHOD DETECTION LIMIT STUDY

GC/MS/SIM PART PER TRILLION PAH/HETEROCYCLES IN WATER

Compound	Mean	Standard Deviation	MDL	Lower Control Limit
Naphthalene	29	15	47	30
Acenapthylene	3.1	0.53	1.7	1.1
Acenapthene	2.9	0.42	1.3	0.83
Fluorene	4.3	0.28	0.88	0.56
Phenanthrene	5.2	1.0	3.1	2.0
Anthracene	3.8	1.1	3.4	2.2
Fluoranthene	7.8	1.4	4.4	2.8
Pyrene	7.7	1.3	4.1	2.6
Benz(a)anthracene	7.4	1.4	4.4	2.8
Chrysene	7.6	1.4	4.4	2.8
Benzofluoranthenes	13	3.1	9.7	6.2
Benzo(a)pyrene	5.6	1.1	3.4	2.2
Indeno(1,2,3,cd)pyrene	7.9	1.4	4.4	2.8
Dibenz(a,h)anthracene	5.5	1.1	3.4	2.2
Dibenzo(g,h,i)perylene	6.3	1.7	5.3	3.4
Indene	3.3	0.92	2.9	1.8
Indole	4.2	0.61	1.9	1.2
2,3-dihydroindene	3.7	1.1	3.4	2.2
2,3-benzofuran	2.8	0.61	1.9	1.2
Quinoline	4.5	0.61	1.9	1.2
Benzo(b)thiophene	4.6	0.71	2.2	1.4
2-methylnaphthalene	6.6	1.6	5.0	3.2
1-methylnaphthalene	4.9	0.98	3.1	2.0
Biphenyl	14	5.4	17	11
Carbozole	5.4	0.84	2.6	1.7
Dibenzofuran	4.7	0.38	1.2	0.77
Acridine	3.6	0.81	2.5	1.6
Dibenzothiophene	4.6	2.0	6.3	4.0
Perylene	3.5	0.52	1.6	1.0
Benzo(e)pyrene	4.8	0.49	1.5	0.96

All values expressed in part per trillion (ppt)

This calculated method detection limit will be used in sample reporting as follows:

- Concentrations of samples (after blank correction, if applicable) less than the lower control limit of the method detection limit will be reported as not detectable (ND).
- Concentrations of samples (after blank correction, if applicable) greater than the lower control limit of the method detection limit, but less than the method detection limit will be reported as less than the MDL, or BDL (below detection limit).

Method Blank and Solvent Blank

The laboratory will analyze 10% laboratory solvent blanks and 5% method blanks as described in Section 4.0, Analytical Method.

The method blank results associated with the sample batch will be used to correct the observed sample concentrations in that batch as indicated below:

- If the concentration in the blank is less than or equal to half of the method detection limit, samples will not be corrected for the blank.
- If the concentration on the blank is greater than half of the method detection limit and is less than or equal to half the concentration detected in the sample, samples will be corrected for the blank by subtracting the value observed for the compound in the blank from the value observed for the same compound in the sample.
- If the concentration in the blank is greater than half the method detection limit and is greater than half the concentration detected in the sample, correction is not possible and the compound in the sample should be reported as not detected (ND). If this situation occurs, the cause of the high blank must be determined and corrective actions taken (See the ERT Analytical Laboratory Quality Control Handbook, Chapter 8).

The solvent blank is not used to correct sample concentrations, but to help determine the cause of contamination in high blanks.

Surrogates

The laboratory will spike all samples and quality control samples with deuterated PAH surrogate compounds. The surrogate compounds will be spiked into the sample prior to extraction and, thus, will measure individual sample matrix effects associated with sample preparation and analysis. They will include naphthalene-d_8, fluorene-d_{10} and chrysene-d_{12}, (or equivalent compounds) at a sample concentration level of 10 ng/ℓ (ppt). The following criteria will be used to determine data validity for each sample:

Surrogate	Minimum Mean	Mean (%)	Standard Deviation (%)	95% Confidence Limits
Naphthalene-d_8	42	72	15	42-102
Fluorene-d_{10}	60	94	17	60-128
Chrysene-d_{12}	20	30	12	10-54

ERT will take corrective action whenever recoveries of any one surrogate are below the surrogate recovery 95% confidence limits.

The following corrective action will be taken when required as stated above:

a) Check calculations to assure there are no errors; check internal standard and surrogate solutions for degradation, contamination, etc.; and, check instrument performance.
b) Reanalyze the sample or extract if the steps in part a) reveal a problem. If reanalysis of the extract gives surrogate spike recoveries within the stated limits, then the reanalysis data will be used. In any event, both the original and reanalysis data will be reported.
c) If a) or b) do not correct the problem, the data for that sample will be reported and clearly noted as not valid for quantitative purposes, to satisfy the objectives of this sampling plan.

Individual sample data validity will be determined utilizing the recoveries obtained for naphthalene-D8, fluorene-D10, and chrysene-D12, based upon the 95% confidence limits specified above. The mean surrogate spike recoveries for the GAC treated water samples must be greater than the minimum mean values specified above.

Method Spikes

The laboratory will spike and analyze 5% method spike samples. Following the Contract Laboratory Program rationale, ERT will spike eight representative compounds into GAC treated water. These compounds and the spiking levels in the GAC treated water sample are listed below:

Naphthalene	100 ng/ℓ
Fluorene	20
Chrysene	20
Benzo(g,h,i)perylene	20
Indene	20
Quinoline	20
Benz(e)pyrene	20
2-methyl naphthalene	20

Naphthalene is spiked at a higher level because of the higher method detection limit. The spiking procedure is outlined in Section 4.0, Analytical Method.

ERT will validate the analytical data by utilizing the method spike sample criteria in conjunction with the surrogate recovery criteria. If the criteria for the method spike are met, only samples which do not meet the surrogate recovery criteria in that batch will be considered invalid. If the method spike criteria are not met then samples associated with the invalid method spike must be reviewed. This review will consider surrogate spike recoveries of the affected samples, analysis history of the method spike, and results of other method spikes analyzed before and after the invalid method spike. Based upon these considerations, taken together, ERT will determine data validity, pending appropriate agencies' approvals, for the affected samples and describe the rationale in support of the decision in the narrative of the QA/QC data report.

The method spike criteria for data validity are as follows:

- The average of the percent recoveries for all eight compounds must fall between 20 and 150 percent.
- Only one compound can be below its required minimum percent recovery. These minimum percent recoveries are:

  1) 10% for chrysene, benzo(g,h,i)perylene, and benz(e)pyrene, and
  2) 20% for all other compounds.

Both method spike and surrogate spike recoveries will be used in assessing quality assurance/quality control for ERT's analytical work.

Duplicates

The laboratory will analyze 10% duplicate samples. Percent difference between duplicates will be calculated for each detected compound. The results will be plotted onto control charts and mean and standard deviation will be calculated.

Additional descriptions of ERT's general laboratory quality control program including control chart construction, interpretation and corrective actions can be found in the ERT Analytical Laboratory Quality Control Handbook.

3.3 Data Review and Reporting

All data will be subjected to a rigorous review process before being reported. All data forms must be dated, signed and completely filled out in ink by the preparer. Notes will be made if information requested is non-applicable for the specific analysis. Each data sheet will be checked, signed, dated and approved by someone other than the preparer.

Out-of-control events or potential out-of-control events are noted on an out-of-control event form. This form is part of the data package and will be completed upon data approval. If no out-of-control events are encountered then this will also be documented. If an out-of-control event does occur during analysis, for instance a surrogate recovery falls outside the expected range, the analyst will describe the event, the investigative and corrective action taken and the cause of the event on this form, and will notify the Quality Control Coordinator (QCC).

After an analyst completes a Data Package, it is given to the Supervisor for review. The Supervisor reviews the entire Data Package for completeness, discrepancies and errors and writes comments, when necessary, on the back of the Data Approval Form. If the supervisor disapproves the Data Package it is given back to the analyst for correction. If it is approved the Supervisor passes it along to the QCC.

The QCC then reviews the Data Package with extra emphasis on the acceptability of quality control data. If the QCC disapproves the Data Package it is rerouted to the Supervisor for corrective action; if the QCC approves it, it is sent to the Laboratory Manager for final approval and report preparation.

Before submission to the client, the final typed report is reviewed by the Program Manager, Laboratory Manager, Supervisors and Quality Control Coordinator for their approval and signatures.

4. ANALYTICAL METHOD

4.1 Summary

This method has been designed for the analysis of carcinogenic PAH and heterocycles at the part per trillion level (ppt, ng/L) in water. The analysis is carried out by isolation of the target analytes by liquid-liquid extraction of the water sample with an organic solvent. Quantitation of the isolated target analytes is performed by gas chromatography mass spectrometry (GC/MS) in the selected ion monitoring mode (SIM). The compounds listed in Table 4-1 can be quantitatively determined using this analytical method.

Four 1-liter volumes of sample are separated into two 2-liter samples and extracted with methylene chloride. Analysis of the combined and concentrated extract is performed by gas chromatography/mass spectrometry using the selected ion monitoring scanning mode under electron impact ionization conditions.

4.2 Inteferences

Method interferences may be caused by contaminants in solvents, reagents, glassware, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the ion current profiles. All of these materials must be routinely demonstrated to be free from interferences under the conditions of the analysis by running laboratory reagent blanks.

Matrix interferences may be caused by contaminants that are coextracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the environment being sampled.

4.3 Apparatus

Glassware

Glassware must be scrupulously cleaned. Clean all glassware as soon as possible after use by rinsing with the last solvent used in it. This should be followed by detergent washing with hot water, and rinses with tap water, reagent water, then methanol. It should then be oven dried at 150°C for 30 minutes, and heated in a muffle furnace at 400°C for 15 to 30 minutes. Solvent rinses with methylene chloride may be substituted for the muffle furnace heating. Volumetric glassware should not be heated in a muffle furnace. After drying and cooling, glassware should be sealed and stored in

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TABLE 4-1

COMPOUNDS AND MS QUANTITATION MASS IONS

Compound	Quantitation Mass Ion	Internal Standard Reference
Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	128	1
Acenaphthylene	152	1
Acenaphthene	154	1
Fluorene	166	2
Phenanthrene	178	2
Anthracene	178	2
Fluoranthene	202	2
Pyrene	202	2
Benzo(a)anthracene	228	3
Chrysene	228	3
Benzofluoranthenes	252	3
Benzo(a)pyrene	252	3
Indeno(1,2,3,cd)pyrene	276	3
Dibenz(a,h)anthracene	278	3
Benzo(g,h,i)perylene	276	3
Internal Standards		
1) Acenaphthene-d10	164	-
2) Phenanthrene-d10	188	-
3) Benz(a)pyrene-d12	264	-
Surrogates		
1) Naphthalene-d8	136	1
2) Flourene-d10	176	2
3) Chrysene-d12	240	3

TABLE 4-1 (Continued)

COMPOUNDS AND MS QUANTITATION MASS IONS

Compound	Quantitation Mass Ion	Internal Standard Reference
Heterocycles and Other PAH		
Indene	116	1
Indole	117	1
2,3-dihydroindene	118	1
2,3-benzofuran	118	1
Quinoline	129	2
Benzo(b)thiophene	134	2
2-methyl napthalene	141	2
1-methyl napthalene	141	2
Biphenyl	154	3
Carbazole	167	3
Dibenzofuran	168	3
Acridine	179	3
Dibenzothiophene	184	3
Perylene	252	3
Benzo(e)pyrene	252	3
Internal Standards		
1) Acenaphthene-d10	164	-
2) Phenanthrene-d10	188	-
3) Benz(a)pyrene-d12	264	-
Surrogates		
1) Naphthalene-d8	136	1
2) Flourene-d10	176	2
3) Chrysene-d12	240	3

a clean environment to prevent any accumulation of dust or other contaminants. Store it inverted or capped with aluminum foil. The use of high purity reagents and solvents helps to minimize interference problems. Purification of solvents by distillation in all-glass systems may be required.

a) Separatory funnel - 2000 mL, with Teflon stopcock.

b) Concentrator tube, Kuderna-Danish - 10 mL, graduated (Kontes K-570050-1025 or equivalent). Calibration must be checked at the volumes employed in the test. Ground-glass stopper is used to prevent evaporation of extracts.

c) Snyder column, Kuderna-Danish - Three-ball macro (Kontes K-503000-0121 or equivalent).

d) Evaporative flask, Kuderna-Danish - 500 mL (Kontes K-570001-0500 or equivalent). Attach to concentrator tube with springs.

e) Snyder column, Kuderna-Danish - two-ball micro (Kontes K-569001-0219 or equivalent).

f) Micro reaction vessels, 2.0 mL (Supelco 3-3295).

Gas Chromatograph

The analytical system is complete with a temperature programmable gas chromatograph and all required accessories including syringes, analytical columns, and gases. The injection port is designed for on-column injection when using packed columns and for splitless injection when using capillary columns.

Column

A J&W 15-meter fused silica capillary column coated with DB-5 bonded phase, or equivalent.

Mass Spectrometer

A mass spectrometer operating at 70 ev (nominal) electron energy in the electron impact ionization mode and producing a mass spectrum which meets all the ion abundance criteria when 50 ng of decafluorotriphenyl phosphine (DFTPP; bis(perfluorophenyl) phenyl phosphine) is injected through the GC inlet. The GC capillary column is fed directly into the ion source of the mass spectrometer.

A computer system interfaced to the mass spectrometer allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer has software that allows searching any GC/MS data file for ions of a specific mass and plotting such ion abundances versus time or scan number. The computer allows acquisition at pre-selected mass windows for selected ion monitoring.

Reagents

a) Reagent water - Reagent water is defined as a water in which an interferent is not observed at the method detection limit of each parameter of interest.

b) Solvents - Acetone, methanol, methylene chloride, benzene, cyclohexane - Burdick & Jackson, distilled in glass, or equivalent.

c) Sodium sulfate - (ACS) Granular, anhydrous. Purify by heating at 400°C for 4 hrs. in a shallow tray.

d) Surrogate Spiking Solution - A solution containing 10 ng/mL of each of naphthalene-d_8, fluorene-d_{10}, and chrysene-d_{12} (or equivalent weight deuterated PAH) is prepared by weighing appropriate aliquots of the purified crystals into a volumetric flask and dilution to volume with methanol or acetone.

e) Internal Standard Solutions - A solution containing ca. 200 ng/mL of each internal standard is prepared by weighing an appropriate aliquot of each purified crystal into a volumetric flask and diluting to volume with methylene chloride. The internal standard compounds are acenaphthene-d10, phenanthrene-d10, and benzo(a)pyrene-d12, or equivalent weight deuterated PAH, not used as a surrogate.

f) Matrix Recovery Standard Spiking Solution - A solution containing the following compounds at the listed concentrations is prepared by weighing an appropriate aliquot of each purified crystal into a volumetric flask and diluting to volume with methanol or acetone.

Compound	Concentration (ng/mL)
Naphthalene	100
Fluorene	20
Chrysene	20
Benzo(g,h,i) perylene	20
Indene	20
Quinoline	20
Benz(e)pyrene	20
2-methylnaphthalene	20

4.4 Extraction

Samples

Samples are extracted at pH >12. Each 4-liter sample is separated into two 2-liter aliquots in two 2-liter separatory funnels. Each 2-liter aliquot is spiked in the separatory funnel with the surrogate spiking solution. A 2.00 mL volume of mixed surrogate spiking standard is added to each 2-liter separatory funnel, to give an approximate concentration of 10 ng/L (10 ppt) of each surrogate. Each aliquot is then extracted three times (80 mL/80 mL/80 mL) with methylene chloride. The three methylene chloride extracts are passed through an anhydrous sodium sulfate drying column, and combined in a Kuderna-Danish evaporative concentrator. The extracts are concentrated to a volume of ca. 1 mL methylene chloride.

Concentrate the extract to ca. 0.5 mL and transfer to a 2.0 mL microreaction vessel containing 0.5 mL (500 ul) of benzene. The methylene chloride is evaporated using a nitrogen stream. The evaporative concentrator tube is successively rinsed with methylene chloride, the rinsings added to the reaction vessel and the methylene chloride again evaporated. Continue this process until at least five (5) 1 mL rinsings of the tube have occurred. Evaporate the final methylene chloride, leaving the 500 ul of benzene. All microreaction vessels should be permanently marked at the 500 µl level and additional benzene added, when necessary, to insure a final 500 µl extract volume. Cap with a Teflon fitted septum cap and store the extract at 4°C prior to GC/MS analysis.

Method Blank

For a minimum of 5% of the analyses performed, prepare a method blank by treating a 4-L sample of laboratory reagent water exactly as described above.

Solvent Blank

For a minimum of 10% of the analyses performed, prepare a solvent blank by introducing methylene chloride into two clean 2-liter separatory funnels (80 mℓ/80 mℓ/80 mℓ). Combine the methylene chloride extracts and continue the concentration exactly as described above.

Matrix Recovery Sample

For a minimum of 5% of the analyses performed, prepare a matrix recovery sample by spiking 2.00 mL of the matrix recovery standard spiking solution into two 2-L volumes of laboratory reagent water. Extract the fortified sample exactly as described above for samples. At this level of spiking, the following compounds will be introduced into the 4-L sample at the following concentrations:

Compound	Concentration (ng/mL)
Naphthalene	100
Fluorene	20
Chrysene	20
Benzo(g,h,i) perylene	20
Indene	20
Quinoline	20
Benz(e)pyrene	20
2-methylnaphthalene	20

Duplicate Sample

For a minimum of 10% of the samples analyzed a duplicate sample will be taken at sampling and a duplicate analysis will be performed. This will be carried out to insure that an estimate of precision will be available.

4.5 GC/MS Calibration

Prior to use of this method a five-point response factor calibration curve must be established showing the linear range of the analysis. For every 12 hours of GC/MS analysis, the mass spectrometer response for each PAH or heterocycle relative to the internal standard is determined, as described in the Calculations Section, using daily check standards at concentrations of 40 ng/mL. Daily response factors for each compound must be compared to the initial calibration curve. If the daily response factors are within ±35 percent of the corresponding calibration curve value the

analysis may proceed. If, for any analyte, the daily response factor is not within ±35 percent of the corresponding calibration curve value, a five-point calibration curve must be repeated for that compound prior to the analysis of samples.

Chromatographic peak location criteria will be established using relative retention time. An initial determination of retention times for each PAH or heterocycle relative to its respective internal standard (Table 4-1) will be made using five-point calibration standards. Average relative retention times and standard deviations will be calculated and 95 percent confidence limits established. Relative retention times of daily calibration standards must be within these 95 percent confidence limits for each PAH or heterocyclic compound. In addition, sample component relative retention times must be within ±0.1 relative retention time units of the standard component relative retention time.

4.6 Daily GC/MS Performance Tests

At the beginning of each 12 hour shift that analyses are to be performed, the GC/MS system must be checked to see that acceptable performance criteria are achieved for DFTPP. This DFTPP performance test requires the following instrumental parameters:

Electron Energy 70 volts (nominal)
Mass Range - 35 to 450 amu
Scan Time - 1.0 sec.

At the beginning of each 12 hour shift, inject 2 µL (50 ng) of DFTPP standard solution. Obtain a background corrected mass spectrum of DFTPP and check that all the key ion criteria in Table 4-2 are achieved. If all the criteria are not achieved, the analyst must retune the mass spectrometer and repeat the test until all criteria are achieved.

4.7 Gas Chromatography/Mass Spectrometry Analysis

Just prior to analysis a 125 µl aliquot of internal standard solution is transferred to the sample vial using a 250 µL syringe, giving a final internal standard concentration of ca. 40 ng/mL in the extract. Representative aliquots are injected into the capillary column of the gas chromatograph using the following conditions:

Injector Temp - 290°C
Transfer Line Temp - 310°C
Initial Oven Temp - 35°C

TABLE 4-2

DFTPP ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
51	30 to 60 percent of mass 198
68	less than 2 percent of mass 69
70	less than 2 percent of mass 69
127	40 to 60 percent of mass 198
197	less than 1 percent of mass 198
198	base peak, 100 percent
199	5 to 9 percent of mass 198
275	10 to 30 percent of mass 198
365	greater than 1 percent of mass 198
441	present but less than mass 443
442	greater than 40 percent of mass 198
443	17 to 23 percent of mass 442

TABLE 4-3

SELECTED ION MONITORING (SIM) SEQUENCE FOR

PAH AND HETEOROCYCLES

Sequence #	M/Z Scanned	Scan # Range	Start Time (Min)
1	116, 118	300-499	5.50
2	128,129, 134, 136	500-599	9.17
3	117, 141, 154	600-719	11.00
4	152, 154, 164, 166, 168, 176	720-899	13.20
5	167, 178, 179, 184 188	900-1049	16.50
6	202, 212	1050-1249	19.25
7	228, 240	1250-1399	22.92
8	252, 264	1400-1649	25.67
9	276, 278	1650-1850	30.25

TABLE 4-4

GC RETENTION BEHAVIOR FOR PAH AND HETEROCYCLES

Compound	M/Z	Retention Scan Number	SIM Sequence #
2,3-benzofuran	118	383	1
2,3-dihydroindene	118	420	1
Indene	116	429	1
Napthalene-d8 (Surr.)	136	548	2
Napthalene	128	551	2
Benzo(b)thiophene	134	557	2
Quinoline	129	593	2
INdole	117	635	3
2-methylnapthalene	141	640	3
1-methylnapthalene	141	653	3
Biphenyl	154	703	3
Acenaphthylene	152	756	4
Acenaphthene-d10 (IS-1)	164	776	4
Acenaphthene	154	781	4
Dibenzofuran	168	802	4
Fluorene-d10 (Surr.)	176	843	4
Fluorene	166	848	4
Dibenzothiophene	184	956	5
Phenanthrene-d10 (IS-2)	188	970	5
Phenanthrene	178	974	5
Anthracene	178	980	5
Acridine	179	985	5
Carbazole	167	1004	5
Fluoranthene	202	1134	6
Pyrene	202	1162	6
Benz(a)anthracene	228	1333	7
Chrysene-d12 (Surr.)	240	1335	7
Chrysene	228	1339	7
Benzofluoranthenes	252	1496	8
Benz(e)pyrene	252	1536	8
Benz(a)pyrene-d12 (IS-3)	264	1539	8
Benz(a)pyrene	252	1543	8
Perylene	252	1546	8
Indeno (1,2,3-cd)pyrene	276	1713	9
Dibenz(a,h)Anthracene	278	1718	9
Benzo(g.h.i)Perylene	276	1750	9

Initial Hold Time - 2 min.
Ramp Rate - 10°C/min.
Final Temperature - 310°C

The effluent from the GC capillary column is fed directly into the ion source of the mass spectrometer. The MS is operated in the selected ion monitoring (SIM) mode using appropriate windows to include the quantitation masses of each PAH or heterocycle as shown in Table 4-1. The time programmed SIM acquisition windows are listed in Table 4-3. Each SIM sequence is acquired at a total scan speed of 1.1 seconds per scan. Typical retention behavior of the combined PAH and heterocycle analytes and corresponding SIM sequences are shown in Table 4-4.

Calculations

The following formula is used to calculate the response factors of the internal standard to each of the calibration standards.

$RF = (A_s C_{is})/(A_{is} C_s)$
where:

A_s = Area of the characteristic ion for the parameter to be measured.
A_{is} = Area of the characteristic ion for the internal standard.
C_{is} = Concentration of the internal standard, (ng/mL).
C_s = Concentration of the parameter to be measured, (ng/mL).

Based on these response factors, sample extract concentration for each PAH is calculated using the following formula.

$$\text{Concentration, ng/mL} = \frac{(A_s)(I_s)}{(A_{is})(RF)}$$

where:

A_s = Area of the characteristic ion for the parameter to be measured.
A_{is} = Area of the characteristic ion for the internal standard.
I_s = Amount of internal standard added to each extract (ng/mL).

The actual sample concentration (C) for each compound is calculated by the following formula:

$$C, \text{ ng/L (ppt)} = \text{Extract Concentration} \times \frac{V_E}{V_s} ,$$

where

V_E = The final extract volume (mL), and
V_s = The original volume of sample extracted (L).

5. REPORTING
(Joint City - ERT Effort)

5.1 Summary

The City of St. Louis Park (City) will provide, for each sample analyzed, four QA/QC data reports - the Analytical Results Report, the Surrogate Recovery Report, QA/QC data the Sampling Report, and the Method Spike Recovery Report. The following discussion describes in detail the contents of these deliverables. In addition, the reporting requirements for samples found to exceed Advisory Levels or Drinking Water Criterion will be discussed.

5.2 Report Descriptions

5.2.1 Sampling Report

Following each sampling event, the city will provide within 21 working days of sample collection, a report containing the following information associated with each sample and sample analysis:

1) Field Identification Designation
2) ERT Laboratory Sample Number
3) Field Logbook/Page Number
4) Date of Collection
5) Date Received at ERT
6) Date Extracted
7) Date Analyzed
8) GC/MS File #
9) GC/MS Tape #
10) Corresponding DFTPP File #
11) Corresponding Matrix Spike Sample #
12) Corresponding Method Blank Sample #
13) Corresponding Solvent Blank Sample #
14) Corresponding GC/MS Calibration Standard File #
15) Description of any problems encountered

5.2.2 Analytical Results Report

The city will provide, within 21 working days of sample collection, a tabulation of analytical results for each 4-L water sample. The analytical

results report will be validated and signed by the Laboratory Manager. Each analytical results report will contain the following: .

1) Field Identification Designation
2) ERT Laboratory Sample Number
3) Analytical Results, in terms of a) individual PAH identification and quantitation (ng/l) b) Total Carcinogenic PAH (ng/l) c) Total Other PAH (ng/l) and d) Total PAH (ng/l)

List of Carcinogenic PAH and Other PAH

The analytical method will provide for identification and quantitation of two groups of target compounds - the Carcinogenic PAH and the other PAH group. Listed in Table 5-1 are the two groups of target compounds. Analytical results will be reported for individual compounds, with the exception of the three benzofluoranthene isomers (b,j, and k). Due to the difficulty in maintaining chromatographic separation of this isomeric series, a total benzofluoranthenes analytical result will be reported. This benzoflouranthenes quantitative result will be utilized in the calculation of total carcinogenic PAH.

Analytical Results Reporting Protocol

The quantitative results for any of the identified target compounds will be reported in one of three possible ways. Concentrations of analytes equal to or greater than the method detection limit (MDL) will be assigned a numerical concentration value, in units of ng/L, reported to two (2) significant figures (i.e. 52 ng/L). Concentrations of analytes identified as present at a level less than the MDL but equal to or greater than the lower confidence limit (LCL) of the 95% confidence interval of the MDL are reported as less than the MDL (<MDL, i.e. <3.0 ng/L). Concentrations of target analytes less than the LCL (95% confidence interval) of the MDL are reported as not detectable (i.e. ND). In all cases, the quantitative results will be corrected for levels observed in the method blank, as described in Section 3.3.

5.2.3 Surrogate Recovery Report

The city will provide, within 21 working days of sample collection, a tabulation of surrogate recovery data for each 4-L water sample analyzed. Each surrogate recovery report will contain the following:

TABLE 5-1

STANDARD PAH AND OTHER PAH COMPOUNDS

FOR IDENTIFICATION AND QUANTITATION

a. Carcinogenic PAH

Compound	Chemical Abstract Service Registry No.
benzo(a)anthracene	(56-55-3)
benzo(b)fluoranthene	(205-99-2)
benzo(j)flyoranthene	(205-82-3)
benzo(k)fluoranthene	(207-08-9)
benzo(ghi)perylene	(191-24-2)
benzo(a)pyrene	(50-32-8)
chrysene	(218-01-9)
dibenz(a,h)anthracene	(53-70-3)
indeno(1,2,3-cd)pyrene	(193-39-5)
quinoline	(91-22-5)

b. Other PAH

Compound	Chemical Abstract Service Registry No.
acenaphthene	(83-32-9)
acenaphthylene	(208-96-8)
acridine	(260-94-6)
Anthracene	(120-12-7)
2,3-benzofuran	(271-98-6)
benzo(e)pyrene	(192-97-2)
benzo(b)thiophene	(95-15-8)
byphenyl	(92-15-8)
carbazole	(86-74-8)
dibenzofuran	(132-64-9)
dibenzothiophene	(132-65-0)
2,3-dihydroindene	(496-11-7)
fluoranthene	(206-44-0)
fluorene	(86-73-7)
indene	(95-13-6)
indole	(120-72-9)
1-methylnaphthalene	(90-12-0)
2-methylnaphthalene	(91-57-6)
naphthalene	(1-20-3)
perylene	(198-55-0)
phenanthrene	(85-01-08)
pyrene	(129-00-0)

1) Field Identification Designation
2) ERT Laboratory Sample Number
3) Spiking concentration for each of the three deuterium labelled surrogate compounds (naphthalene-d_8, fluorene-d_{10}, chrysene-d_{12})
4) Percent recovery result for each of the three surrogate compounds.

5.2.4 Method Spike Recovery Report

The city will provide, within 21 working days of sample collection, a method spike recovery report.

5.2.5 Reporting Requirements for Samples Exceeding Advisory Levels or Drinking Water Criterion

ERT will notify the City of St. Louis Park by telephone, within 24 hours of completing an analysis, whenever a sample analysis is shown to exceed the following Advisory Levels or Drinking Water Criterion:

Parameter	Advisory Level	Drinking Water Criterion
Sum of Benzo(a)pyrene and Dibenz(a,h)anthracene	3.0 ng/L	5.6 ng/L
Total Carcinogenic PAH	15 ng/L	28 ng/L
Total Other PAH	175 ng/L	280 ng/L

A written report shall be submitted by ERT within 2 working days following the original telephone notification. In the event it is determined by the City that the analytical results were achieved due to improper procedures or practices, ERT will note this finding and proceed with retesting as directed by the City. Subsequent retesting will be completed with a written report submitted to the City within eighteen (18) days of receipt of notice to proceed (issued either verbal or written). Furthermore, in the event the city determine that all procedures of the analysis were proper and that a defined level had been exceeded, ERT will complete the necessary retest, including submittal of the written report, within eighteen (18) days of receipt of notice to proceed (issued either verbal or written).

The city shall submit the written report to the agencies within 20 days of the retest.